

WHAT IS CLAIMED IS:

1. An oxygen scavenging composition, comprising:

an oxygen scavenging polymer comprising structure I:

5 (I) $-(X-R-X-O-CH_2-Ar-CH_2-O)-$,

wherein -R- is selected from the group consisting of C₁-C₂₄ alkyl, C₁-C₂₄ substituted alkyl, C₆-C₂₄ aryl, and C₆-C₂₄ substituted aryl; -Ar- is selected from the group consisting of C₆-C₂₄ aryl and C₆-C₂₄ substituted aryl; and -X- is selected from the group consisting of null and -C(=O)-;

10 a transition metal oxidation catalyst; and

an energy-absorbing compound selected from the group consisting of microwave reactive materials and photoinitiators having a wavelength of maximum absorption of electromagnetic radiation from about 200 nm to about 750 nm.

15 2. The oxygen scavenging composition of claim 1, wherein the polymer consists essentially of units having structure I.

3. The oxygen scavenging composition of claim 1, wherein the transition metal oxidation catalyst is a cobalt salt.

20

4. The oxygen scavenging composition of claim 3, wherein the cobalt salt is selected from the group consisting of cobalt oleate, cobalt stearate, and cobalt neodecanoate.

25 5. The oxygen scavenging composition of claim 1, wherein the photoinitiator is selected from the group consisting of benzophenone derivatives containing at least two benzophenone moieties and having the formula:



30

wherein

- 5 A is a bridging group selected from sulfur; oxygen; carbonyl; $-\text{SiR}''_2-$, wherein each R'' is individually selected from alkyl groups containing from 1 to 12 carbon atoms, aryl groups containing 6 to 12 carbon atoms, or alkoxy groups containing from 1 to 12 carbon atoms; $-\text{NR}'''$ -, wherein R''' is an alkyl group containing 1 to 12 carbon atoms, an aryl group containing 6 to 12 carbon atoms, or hydrogen; or an organic group containing from 1 to 50 carbon atoms;
- a is an integer from 0 to 11;
- 10 B is a substituted or unsubstituted benzophenone group; and
- b is an integer from 2 to 12.
6. The oxygen scavenging composition of claim 5, wherein the photoinitiator is selected from the group consisting of dibenzoyl biphenyl, substituted dibenzoyl biphenyl, benzoylated terphenyl, substituted benzoylated terphenyl, tribenzoyl triphenylbenzene, substituted tribenzoyl triphenylbenzene, benzoylated styrene oligomer, and substituted benzoylated styrene oligomer.
- 15 7. An oxygen barrier packaging article, comprising:
an oxygen scavenging polymer comprising structure I:
- 20 (I) $-(\text{X}-\text{R}-\text{X}-\text{O}-\text{CH}_2-\text{Ar}-\text{CH}_2-\text{O})-$,
wherein $-\text{R}-$ is selected from the group consisting of C_1 - C_{24} alkyl, C_1 - C_{24} substituted alkyl, C_6 - C_{24} aryl, and C_6 - C_{24} substituted aryl; $-\text{Ar}-$ is selected from the group consisting of C_6 - C_{24} aryl and C_6 - C_{24} substituted aryl; and $-\text{X}-$ is selected from the group consisting of null and $-\text{C}(=\text{O})-$;
- 25 a transition metal oxidation catalyst; and
an energy-absorbing compound selected from the group consisting of microwave reactive materials and photoinitiators having a wavelength of maximum absorption of electromagnetic radiation from about 200 nm to about 750 nm.
- 30 8. The packaging article of claim 7, wherein the oxygen scavenging polymer consists essentially of units having structure I.

9. The packaging article of claim 7, wherein the transition metal catalyst is a cobalt salt.

5 10. The packaging article of claim 9, wherein the cobalt salt is selected from the group consisting of cobalt oleate, cobalt stearate, and cobalt neodecanoate.

10 11. The packaging article of claim 7, wherein the energy-absorbing compound is a photoinitiator selected from the group consisting of benzophenone derivatives containing at least two benzophenone moieties and having the formula:



wherein

15 A is a bridging group selected from sulfur; oxygen; carbonyl; $-\text{SiR}''_2-$, wherein each R'' is individually selected from alkyl groups containing from 1 to 12 carbon atoms, aryl groups containing 6 to 12 carbon atoms, or alkoxy groups containing from 1 to 12 carbon atoms; $-\text{NR}'''-$, wherein R''' is an alkyl group containing 1 to 12 carbon atoms, an aryl group containing 6 to
20 12 carbon atoms, or hydrogen; or an organic group containing from 1 to 50 carbon atoms;

a is an integer from 0 to 11;

B is a substituted or unsubstituted benzophenone group; and

b is an integer from 2 to 12.

25

12. The packaging article of claim 11, wherein the photoinitiator is selected from the group consisting of dibenzoyl biphenyl, substituted dibenzoyl biphenyl, benzoylated terphenyl, substituted benzoylated terphenyl, tribenzoyl triphenylbenzene, substituted tribenzoyl triphenylbenzene, benzoylated styrene oligomer, and substituted benzoylated
30 styrene oligomer.

13. The packaging article of claim 7, further comprising an antioxidant in the oxygen barrier layer.

14. The packaging article of claim 13, wherein the antioxidant is selected from the group consisting of 2,6-di(t-butyl)-4-methylphenol(BHT), 2,2'-methylene-bis(6-t-butyl-p-cresol), triphenylphosphite, tris-(nonylphenyl)phosphite, vitamin E, tetra-bismethylene 3-(3,5-ditertbutyl-4-hydroxyphenyl)-propionate methane, and dilaurylthiodipropionate.

15. The packaging article of claim 7, wherein the oxygen barrier layer further comprises an oxygen barrier polymer selected from the group consisting of poly(ethylene vinyl alcohol) (EVOH), polyacrylonitrile, polyvinyl chloride (PVC), poly(vinylidene dichloride), polyethylene terephthalate (PET), and polyamide.

16. The packaging article of claim 7, further comprising an oxygen barrier layer.

17. The packaging article of claim 16, wherein the oxygen barrier layer comprises poly(ethylene vinyl alcohol) (EVOH), polyacrylonitrile, polyvinyl chloride (PVC), poly(vinylidene dichloride), polyethylene terephthalate (PET), or polyamide.

18. The packaging article of claim 17, wherein the oxygen barrier layer comprises EVOH, and the packaging article further comprises a moisture barrier layer.

19. The packaging article of claim 18, wherein the moisture barrier layer comprises polyethylene, polyethylene terephthalate (PET), or a mixture thereof.

20. The packaging article of claim 7, further comprising a structural layer.

21. The packaging article of claim 20, wherein the structural layer comprises polyethylene, low density polyethylene, very low density polyethylene, ultra-low density polyethylene, high density polyethylene, polypropylene, polyethylene terephthalate (PET), polyethylene naphthalate (PEN), nylon, polyvinyl chloride, ethylene-vinyl acetate,

ethylene-alkyl (meth)acrylates, ethylene-(meth)acrylic acid, ethylene-(meth)acrylic acid ionomers, aluminum foil, or paperboard.

5 22. The packaging article of claim 21, wherein the structural layer comprises PET, aluminum foil, or paperboard.

10 23. The packaging article of claim 7, wherein the oxygen barrier layer is a liner, coating, sealant, gasket, adhesive insert, non-adhesive insert, or fibrous mat insert in the packaging article.

15 24. The packaging article of claim 7, wherein the packaging article is in the form of a single layer film, a multilayer film, a single layer rigid article, or a multilayer rigid article.

20 25. A method of initiating oxygen scavenging by an oxygen scavenging composition, comprising:

(a) providing an oxygen scavenging composition, comprising:

(i) an oxygen scavenging polymer comprising structure I:

(I) $-(X-R-X-O-CH_2-Ar-CH_2-O)-$,

25 wherein -R- is selected from the group consisting of C₁-C₂₄ alkyl, C₁-C₂₄ substituted alkyl, C₆-C₂₄ aryl, and C₆-C₂₄ substituted aryl; -Ar- is selected from the group consisting of C₆-C₂₄ aryl and C₆-C₂₄ substituted aryl; and -X- is selected from the group consisting of null and -C(=O)-;

(ii) a transition metal oxidation catalyst; and

30 (iii) an energy-absorbing compound selected from the group consisting of microwave reactive materials and photoinitiators having a wavelength of maximum absorption of electromagnetic radiation from about 200 nm to about 750 nm; and

(b) exposing the oxygen scavenging composition to electromagnetic radiation for a duration sufficient to initiate oxygen scavenging by the oxygen scavenging composition.

26. The method of claim 25, wherein the electromagnetic radiation has a peak wavelength from about 50 nm shorter than the wavelength of maximum absorption of the energy-absorbing compound to about 50 nm longer than the wavelength of maximum absorption of the energy-absorbing compound.

27. The method of claim 26, wherein the electromagnetic radiation has a peak wavelength from about 10 nm shorter than the wavelength of maximum absorption of the energy-absorbing compound to about 10 nm longer than the wavelength of maximum absorption of the energy-absorbing compound.

28. The method of claim 25, wherein the polymer consists essentially of units having structure I.

29. The method of claim 25, wherein the transition metal oxidation catalyst is a cobalt salt.

30. The method of claim 29, wherein the cobalt salt is selected from the group consisting of cobalt oleate, cobalt stearate, and cobalt neodecanoate.

31. The method of claim 25, wherein the energy-absorbing compound is a photoinitiator selected from the group consisting of benzophenone derivatives containing at least two benzophenone moieties and having the formula:

$A_a(B)_b$

wherein

A is a bridging group selected from sulfur; oxygen; carbonyl; $-\text{SiR}''_2-$, wherein each R'' is individually selected from alkyl groups containing from 1 to 12 carbon atoms, aryl groups containing 6 to 12 carbon atoms, or alkoxy groups containing from 1 to 12 carbon atoms; $-\text{NR}'''$, wherein R''' is an

alkyl group containing 1 to 12 carbon atoms, an aryl group containing 6 to 12 carbon atoms, or hydrogen; or an organic group containing from 1 to 50 carbon atoms;

a is an integer from 0 to 11;

5 B is a substituted or unsubstituted benzophenone group; and

b is an integer from 2 to 12.

32. The method of claim 31, wherein the photoinitiator is selected from the group consisting of dibenzoyl biphenyl, substituted dibenzoyl biphenyl, benzoylated terphenyl, substituted benzoylated terphenyl, tribenzoyl triphenylbenzene, substituted tribenzoyl triphenylbenzene, benzoylated styrene oligomer, and substituted benzoylated styrene oligomer.

10

15